mounted in the British Guiana Museum which I examined some years ago, and noted the characters of its nose-pad. This skull closely agrees with the dimensions of F. Cuvier's type kindly supplied to me by Prof. Trouessart.

In addition we have a skin without skull from Trinidad, therefore a topotype of F. Cuvier's *L. insularis*, which it may be taken to represent.

Unfortunately, as Prof. Trouessart informs me, the typical mounted skins of neither *L. enudris* nor *L. insularis* are now to be found in the Paris Museum. Happily by the help of the type skull of the former and the British Museum topotype of the latter we are able to identify both with practical certainty.

LXIV.—*The Inclusion of Foreign Bodies by Sponges, with a Description of a new Genus and Species of Monaxonida.*

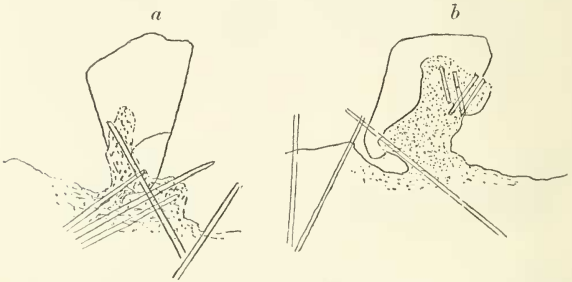
By Igerna B. J. Sollas.

Owing to the kindness of the captain of the 'Durham Castle' the Members of the British Association were allowed to land at Mozambique and at Mombasa on the homeward journey from South Africa in September 1905. An opportunity of half an hour's shore-collecting was thus afforded, and at Mozambique there was a rich growth of sponges, particularly of *Cinachyra voeltzkowi*, Lfd. One sponge, *Migas porphyrion*, gen. et sp. n., which, owing to its consistency and general appearance, I supposed would prove to be a member of the Ceratosa, is, in fact, an interesting form of Monaxonida which possesses a skeleton consisting of both "proper" spicules and foreign bodies. Certain features in the cortex of this specimen seem to me to throw some light on the method by which foreign bodies are included in this case and possibly also in the case of other sponges.

Migas porphyrion is a massive sponge; the surface is raised into a system of low ridges. The single specimen which I possess measures $4{\cdot}5 \times 2{\cdot}5$ cm. A fine individual of *Cinachyra voeltzkowi* has fixed and grown upon a part of its surface. The colour when living was dark purple, outwardly buff in the deeper parts; in spirit the purple has turned to grey. The dark pigment is contained in the granular cells of the cortex. The cortex is ·8 mm. at its greatest thickness and contains large cavities. The chambers are very small, ·015 mm. in diameter, few and aphodal.

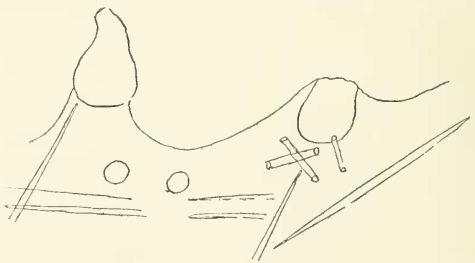
The proper skeleton consists of not very numerous oxeas measuring ·96 × ·016 mm., and arranged partly in loose strands, partly irregularly. The strands run up to the surface and their free ends project. This spicular skeleton is supplemented by sand-grains scattered through the tissues and quite unconnected with one another. Most of them have a covering of some brown substance.

Fig. 1.



a and *b*. Portions of the surface of *Migas porphyrion*, showing the inclusion of sand-grains by pseudopodia-like extensions of the surface-tissue.

Fig. 2.



Portion of the surface of *Migas porphyrion*, showing a sand-grain seated on a pillar of cortical tissue.

The incorporation of foreign bodies occurs commonly among Ceratosa, and in the Monaxonida it is found in the Gelliodine genera *Phoriospongia* and *Sigmatella*, in the

Dendoricine species *Tedania commixta*, R. & D., and in the Ectyonine genus *Aulena*. In *Psammopemma* among Ceratosa and in *Tedania commixta* the foreign bodies are not enclosed in fibres, but lie in the ground-substance. Professor Minchin * speaks of this phenomenon as a "remarkable property possessed by the spongin fibres," and says, "Sand-grains . . . and such-like bodies which fall on to the surface of the sponge-body become included in the fibres, apparently by adhering to the tip of the fibre at its growing point, where it is continuous in all probability with the external cuticle of the sponge-body. The absorption of foreign particles into the spongin fibre is therefore not so much a question of their travelling down into it as of their being passively surrounded by spongin as the fibre grows upwards."

The appearance of the surface of the present species suggests that here, at any rate, inclusion takes place in a different manner. In thick freehand sections the sand-grains lying on the surface are seen to be enveloped by the superficial tissue of the sponge, which is raised up round them and adheres to them. Sometimes pseudopodia-like extensions of the sponge-tissue are found partially enwrapping the grain (fig. 1). When sand-grains are found, as in fig. 2, attached to the apex of a conulus, I believe that this results from a flow of material to the neighbourhood of the irritant grain, not from the sand-grain having fallen upon the summit of a conulus.

The abundance of sand-contents makes it difficult to cut thin sections while the grains are in place, the tissues were therefore demineralized with hydrofluoric acid. In sections of material treated for a day or two with this reagent some remnants of siliceous fragments were still present, but the outer layers were sufficiently free to admit of fairly thin sections being cut. In these sections it is seen that in the cortex there are numerous cells containing coloured granules; of these some are confined to the cortex, others aggregated in oval cell-clusters occur throughout the tissues. In both cases the granules conceal the nucleus. The granular cells are frequently elongated and fusiform; sometimes, particularly beneath remnants of foreign bodies (fig. 3) and on the flat summits of the low ridges of the cortex, they are of irregular rounded shape or lobed, and they are massed together in numbers. The surface of the sponge appears to me to be absolutely devoid of cuticle and to be bounded by granular cells. This observation was found to hold good also in

* 'A Treatise on Zoology' (edited by E. Ray Lankester), 1900, p. 42.

sections of selected bits of cortex which, owing to their comparative freedom from sand-contents, could be cut without desilicification. I cannot doubt that the inclusion of sand-grains is due to the activity of these small granular amœbocytes; and I think it is worth while to consider whether some similar cellular activity is not responsible for the inclusion of foreign bodies in sponges generally, for, on the hypothesis that this phenomenon is a property of the spongin-fibre, the fact of selection of particular kinds of foreign bodies by various species remains unexplained. Why, for example, do fibres of *Phyllospongia silicata* contain foreign spicule fragments, while in various other species of *Phyllospongia* sand-grains are found as the fibre-core? or, again, in *Hippospongia* why should one group of species possess fibres free from foreign bodies, while in a second and third group the fibres contain foreign spicules and sand-grains respectively? It seems to me still more difficult to account for the skeleton of some

Fig. 3.

Thin section of the desilicified cortex of *Migas porphyrion*.
a, partially dissolved sand-grain.

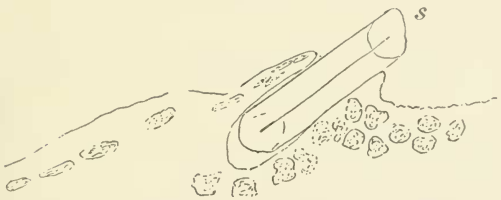
species of *Aulena* without the assumption of the selection of fibre-contents by cellular activity. Thus in *Aulena gigantea* in addition to the supporting skeleton, which is cored by sand-grains, there is a surface skeleton consisting of (1) siliceous spicules lying irregularly in the "skin," (2) a tangential network of stout fibres cored with an axial series of sand-grains, (3) echinated fibres running from these to the surface and cored with spicules. "The spicules in the skin are partly foreign, like those which are found in the axis of the echinated fibres" (Lendenfeld's description). The tangential network (2) being remote from the surface, surely the sand-grains must be carried to it.

Again, when foreign spicules are included in the fibre they are arranged with their long axes parallel to the axis of the

fibre. It can hardly be supposed that they fall on to the fibre-tip and adhere in this position.

In a sponge which I have described elsewhere as *Euspongia officinalis*, ? var. *rotunda*, the following points are to be noted:— The cortex is closely like that of *Migas porphyrion*, but deeper, and, being free from loose sand-grains, is easy to cut. The whole appearance suggests a tissue of which the cells are in active motion. There is an abundance of amœboid granular cells (like the smaller granular cells of *Migas porphyrion*); in places these form, as it were, streams of fusiform cells, but in other places the cell-bodies are more massive and crowded together. Often when the aggregation occurs at the surface the latter has minute irregularities, suggesting pseudopodia. Where foreign spicules are to be found just beginning to pass into the sponge there are clustered lobose granular cells (fig. 4). An argument which seems to me to be worth

Fig. 4.



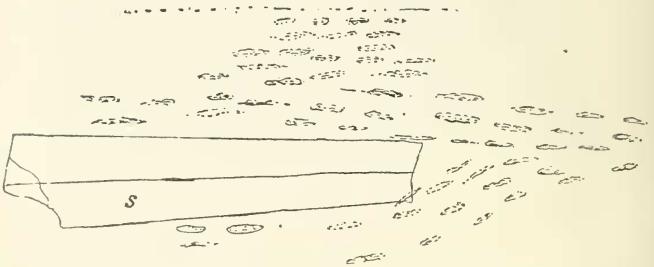
From the surface of *Euspongia officinalis*, ? var. *rotunda*.
s, foreign spicule fragment.

considering is this: within the cortex are scattered spicular fragments lying more or less parallel to the surface and obviously occupying the position which they had in the living sponge (fig. 5). Now the main fibres alone contain foreign bodies, and there are no free spicule fragments in the deeper parts of the sponge. What, then, is the meaning of this temporary position of the spicule fragments if it is not that they are on their way to the main fibres to which they are being carried by the granular cells? It is difficult to understand the concerted action of amœbocytes, but it is not more difficult in this case than in that of the wonderful migrations of cells carrying spicules with them which Evans has shown to occur during the formation of the gemmule-coat of *Spongilla*. Cotte attributes the excavating power of

Cliona to the action of amœboid cells at its surface; so that the foregoing suggestions are not without precedent, and, seeing that amœboid action within the sponge-body is well established, it would not be surprising if in such lowly creatures it should also occur at the outer surface.

Fig. 5.

External surface



From the cortex of *Euspongia officinalis*, var. *rotunda*.
s, foreign spicule fragment.

When I wrote the foregoing remarks I was unaware that the subject had already been discussed. The following statement of the position of the discussion is taken from von Lendenfeld's 'Monograph of Horny Sponges,' 1889, p. 768:—

"... The sponge *selects* from the material deposited [by currents and waves] such particles as it requires, and allows them to sink into the skin. Haeckel originally assumed that an active selection took place. This was contested by Schulze, who was of opinion that the selection, about the existence of which there cannot be any doubt, was not active but passive, and he compared the differences in the size and nature of the foreign bodies in different sponges and their uniformity in one and the same specimen with an ordinary sedimentary process, as the deposit of rough gravel in one part of a river-bed and the deposit of fine sand in the other. If Schulze's hypothesis be correct, that the nature of foreign bodies in sponges is the result of (1) the *physical* properties of the sponge, and (2) the circumstances of its surroundings, then, of course, the nature of the foreign bodies would change if the surrounding circumstances (premiss 2) changed. But this is not the case. In whatever circumstance the sponge grows

it always takes in the same kind of foreign matter. The sponges from widely different localities and depths are in this respect the same. We must therefore assume that a sponge *selects* from the numerous foreign bodies which fall on and adhere to its surface a certain kind only, and uses them to build up its fibres."

In conclusion, the case of *Tedania commixta* deserves a word of mention in that it shows that the inclusion of the sand-grains may occur as a result of more than one kind of activity of the sponge-tissues. In this species, of which I was fortunate enough to obtain a fragment through the kindness of Mr. Kirkpatrick, the body is divisible into (i.) an upper region, which has a well-developed spicular skeleton with a few sand-grains of small size scattered in the flesh and apparently taken in at the upper surface of the sponge, and (ii.) a lower region, in which the spicular skeleton is still present and more irregular, and in which numerous foreign bodies of various kinds and often of large size occur. So abundant is the foreign matter, and so large the size of many of the fragments, that there can hardly be any question of these included substances having passed through the upper region of the sponge; rather, the sponge has grown downwards, including as it grew the constituents of its substratum. Thus both the tissues of the free surface and of the basal surface appear in this case to engulf foreign matter.

LXV. — *New African Phlebotomic Diptera in the British Museum (Natural History).*—Part II. *Tabanidæ (continued).* By Ernest E. Austen *.

Genus Hæmatopota, Meigen.

The following pages contain descriptions of twelve new species from Tropical Africa belonging to this genus, and at least as many more, examples of which are included in the National Collection, have yet to be described. Of most of these, descriptions will appear in the next instalment of this series of papers. Owing to the complicated nature of the wing-markings in *Hæmatopota*, which in most cases present valuable specific characters, the drawing-up of recognizable

* For Part I. see Ann. & Mag. Nat. Hist. ser. 8, vol. i. (March 1908) pp. 209–228.